THE TFP AND A PULSED LD: NEW LIDAR COMPONENTS

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One of the large problems of lidar in practical use is that the price and the weight of a laser and a receiving telescope is too high. To solve this problem, many trials have been made.

In this paper, the system with the TFP (thin film paraboloid)[1)2)] for a receiving telescope and a pulsed LD (laser diode) for a laser source is proposed. Then, the lidar system will become very lightweight and inexpensive.

The TFP is made of an aluminum coated polyester film which is stretched across a circular ring and a pressure difference is created between the upper and lower surfaces. Due to the pressure difference, the surface of the film has a strain. The shape of the surface can be approximated by a paraboloid. When the ratio of focal length to the diameter of the TFP is almost 1, the effective diameter of the TFP where the surface is useful as a lidar receiver is about half of the actual diameter size of the TFP. The merits of the TFP are it is extremely lightweight and inexpensive. The thickness of the polyester film is only 100 m. The aluminum coated polyester film whose width is 1m is commercially available and the price is $\$10/m^2$. We made a 90 cm in diameter TFP from $1m^2$ film. The top and the side view of the TFP are shown in Fig. 1.

Pulsed LDs are commercially available from M/A-Com Laser Diode,Inc. etc. The maximum output power of LDs are 1kw at the wavelength of 904 nm and 75 w at 850 nm. A pulsed output whose pulse width is 50 nsec and repetition rate is 500 Hz can be obtained by using a simple driver. The weight of the driver is only 1 kg and the weight of the LD is negligible. Although the output energy per pulse of a pulsed LD is very small compared with conventional pulsed laser sources, it can be used as a lidar energy source if it is combined with the large size TFP.

The schematic diagram and the specifications of the lidar system which was composed of the 90 cm in dia. TFP and a 75W peak power LD are shown in Fig.2 and Table 1, respectively. In Fig. 2, the collected signal light is passed through an interference filter and received by an photomultiplier whose photocathode is made by GaAs. The output of the photomultiplier is analog to digital converted by a transient recorder. The converted signal is summed up by an accumulator and stored by a magnetic disk.

The example of the received signal which is the vertical distribution of aerosol is shown in Fig. 3 Fig. 3 (a) is the A scope signal and (b) is the range corrected one. The observation time was 1 min (30000 pulses). From Fig. 3, it can be concluded that an aerosol distribution within 1.5 km can be obtained easily by using the system.

References

1) Hiroshi Shimizu, Nobuo Sugimoto and Yoshikazu Iikura, Conference abstract of lasers and electro-optics, Baltimore, U.S.A. 21-24 May 1985, p.264

2) Hiroshi Shimizu, To be presented in Applied Optics Vol. 25, No. 9

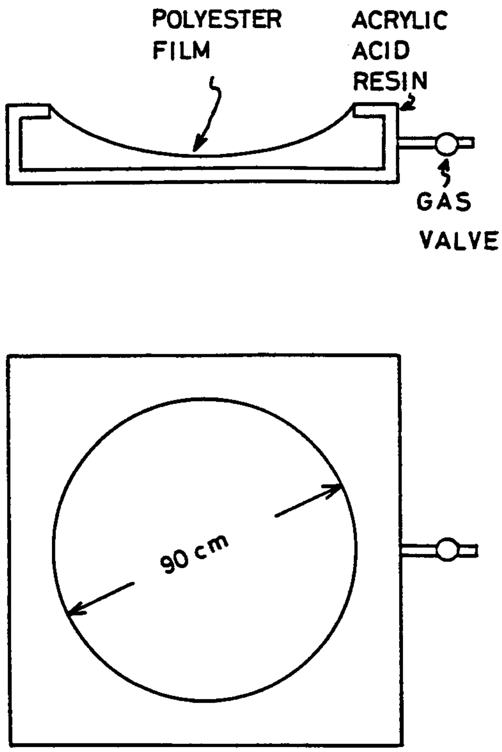

Fig. 1 Side and top view of the 90cm dia TFP.

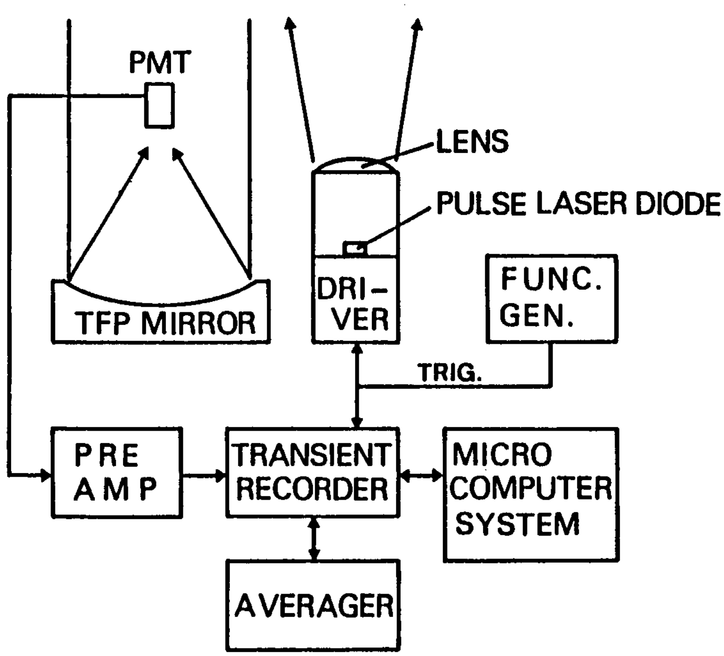

Fig. 2 Schematic drawing of the TFP plus LD lidar system

Table 1 Specifications of the TFP + LD lidar system

TFP	
diameter	90cm
focal length	150cm
thickness of film	100μm
LD	
maker	M/A-com LD
model	LA-167
max. power	75W
pulse width	75nsec
wavelength	858nm

photo-multiplier	
maker & MODEL	Hamamatsu R636
transient recorder	
maker & model	Autnics S121
min. sampling time	50nsec
resolution	10bits
accumulator	
maker & model	Autnics F601
access time	1μsec
micro computer	
maker & model	Sord M343

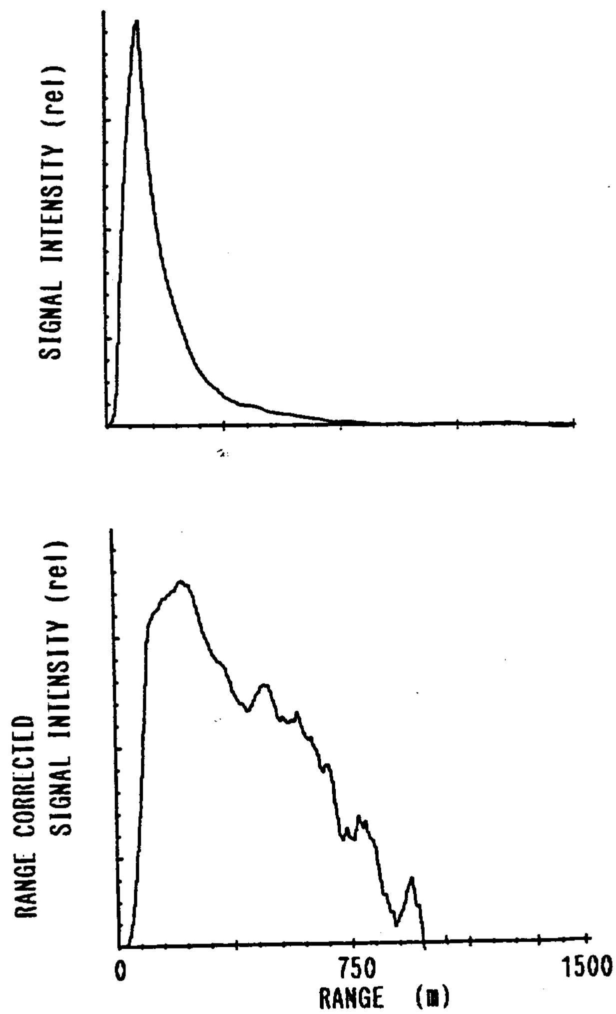

Fig. 3 Measured lidar signal